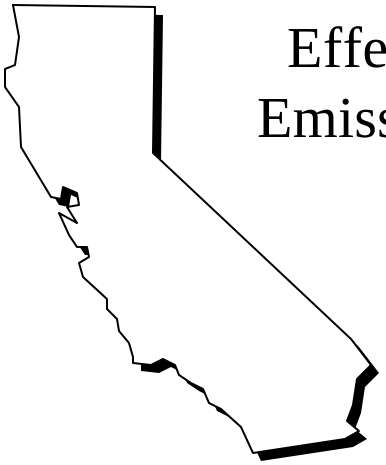


Effects of Trap-related Emissions on Air Quality

Don McNerny
October 2, 2001

California Environmental Protection Agency

Air Resources Board

Presentation Overview

- Changes in Exhaust Emissions/Composition
- Models Used for Estimating Air Quality Impacts
- Air Quality Impacts
- Conclusions/ Next Steps

Changes in Exhaust Composition

- Assumed all On-road and most Off-road Diesels trap-equipped
- Total mass of NOx emissions unchanged
- Changes in NOx speciation
  - without trap 88% NO, 10% NO2, 2% HONO
  - with trap 48% NO, 50% NO2, 2%HONO
- Sensitivity study of hydrocarbons and aldehydes (set to zero)

Models Used for Estimating Impacts

- Photochemical Ozone Model
  - Latest chemistry
  - Validated based on recent ambient monitoring
  - Will be used for future clean air plans
- Predicts summer concentrations of
  - Ozone
  - NO_2
  - nitric acid
  - nitric acid-derived PM

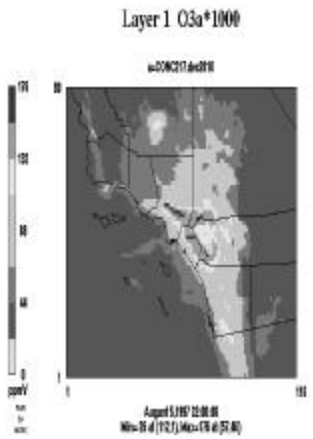
Emissions in Southern California

(Tons/Day in 2010)

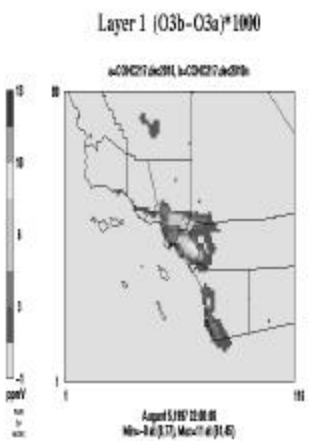
Ozone

(Peak hour)

Base Case

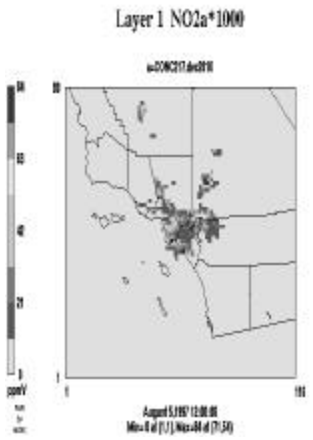


Change w/ Traps

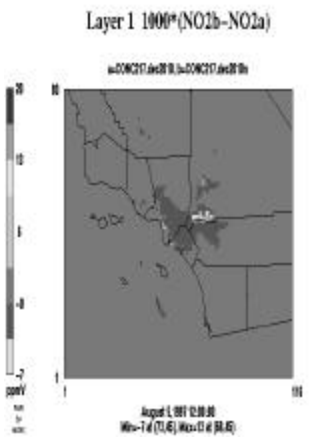


Nitrogen Dioxide
(Peak hour)

Base Case

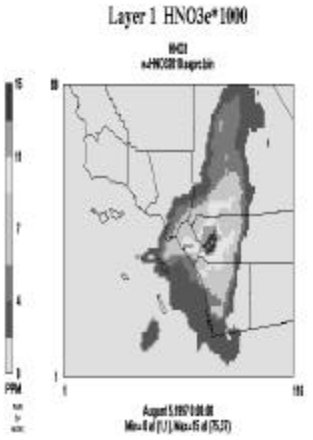


Change w/Traps

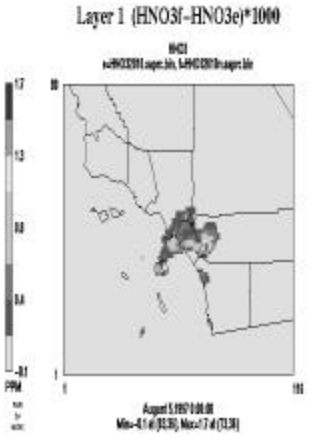


Nitric Acid
(24 Hour Average)

Base Case



Change w/Traps



Summary of Impacts

- Ozone
  - 4-7% increase in high ozone areas (11 ppb max.)
  - State ambient standard is 90 ppb
- Nitrogen Dioxide
  - 22% increase in one small area
  - ~5% in other areas
  - Remains below health-based ambient standard

Sensitivity to Hydrocarbon Assumptions

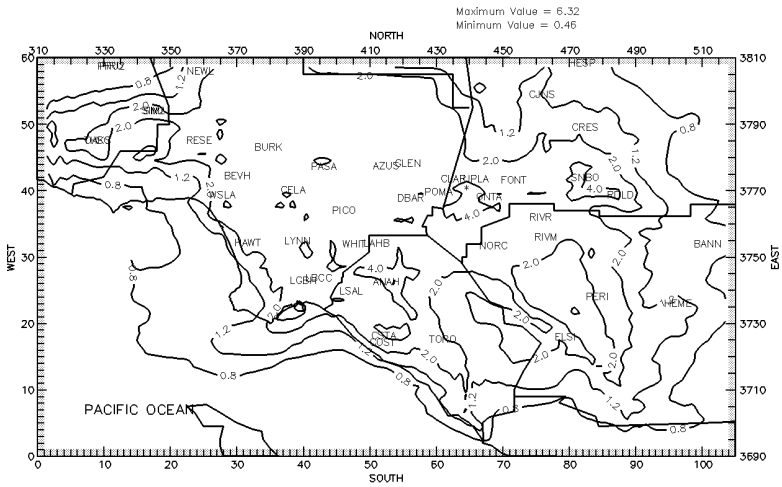
- Aldehydes
  - Assumed diesel aldehyde emissions = zero
  - Reduces peak ozone increase from 11 to 9 ppb
- Non-methane hydrocarbons
  - Assumed diesel NMHC emissions = zero
  - Reduced peak ozone increase from 11 to 6

Summary of Impacts (continued)

- Nitric acid (24 hour)
  - 6-12% increase (1.7 ppb)
  - Linked to reduced child lung development
- Nitric acid-derived PM (24 hour)
  - 5.5 ug/m^3 increase (compared to 50 ug/m^3 air quality standard)

Directly Emitted Diesel PM

(Modeled Annual Average)



Source: SCAQMD Mates-II, March 2000

Uncertainties

- Diesel Exhaust Composition Not Well Known
  - aldehydes (limited data)
  - HONO (no data)
- Possible Increase in Nitro PAH Not Evaluated
  - PAH emissions data not yet analyzed
  - Photochemical model needs revision

Conclusion

- Passive traps increase NO2 emissions significantly
- Increased NO2 emissions result in
  - Increased summer peak ozone (4-7%)
    - HC reductions cut increase by half
  - Increased summer NO_2 (but below standard)
  - Increased summer nitric acid (6-12%)
  - Increased summer nitric acid-derived PM (~10% of allowable ambient PM standard)
    - Reduced elemental carbon emissions may offset

Next Steps

- Apply aerosol model to predict daily PM effects, both summer and winter
- Revise chemistry to evaluate Nitro PAH
- Apply annual model to predict Nitric Acid/ PM annual average effects
- Improve emission estimates